Fobes, J. H.

SURGERY OF THE SPLEEN

A SYMPOSIUM

Conducted by the Class of nineteen hundred and seventeen, of the New York Homœopathic Medical College and Flower Hospital.

Presented With The Best Wishes
Of Your Teacher

JOSEPH HENRY FOBES, M. D., F. A. C. S.

4

MAY
Nineteen Hundred And Seventeen

[Tobey, Joseph Henry, comp.]

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A Symposium on the Spleen.

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Anatomy of the Spleen

BY

Joseph Kotin, Class of 1917.

SINCE the spleen is generally considered as a lymphatic organ, and since recent researches have shown that its structure is quite comparable to that of the lymph glands, it seems advisable to consider it under the head of lymphatic organs.

Its ultimate origin is not yet settled and the details of its later development are still obscure. Its structure differs from that of the lymph glands, chiefly in that it possesses no distinct lymphatic sinuses, but it does possess lymph follicles, splenic corpuscles, densely cellular cords and pulp cords, which are separated by cavernous blood vessels. For some time the spleen was considered as a derivative primarily of the mesenchyme in region of dorsal mesogastrium. More recently, however, investigators have taken the view that it arises partly or possibly entirely from the mesothelium of the dorsal mesogastrium. In human embryos, during 5th week, the analogue of the spleen appears as an elevation on the left side of the mesogastrium. This elevation is produced by local thickening and vascularization of the mesenchyme, accompanied by a thickening of the mesothelium, which covers it. Cells from the mesothelium then migrate into the subjacent mesenchyme and the latter becomes much more cellular. The migration is brief, and, in embryos of about 42 days, has ceased, and the mesothelium is again reduced to a single layer of cells. The elevation becomes larger and projects into the body cavity. At first it it attached to the mesentery and mesogastrium by a broad thick base, but as development pro-

ceeds the attachment becomes relatively small and finally forms only a narrow band of tissue through which the blood vessels of the spleen pass.

Further development of the substance of the spleen consists of the breaking up of the cellular mesenchymal tissue by blood vessels and the formation of splenic corpuscles. The connective tissue trabeculæ, as well as the capsule of the spleen, are derived from the original mesenchymal tissue. Blood vessels become dilated in parts of their course to form the cavernous vessels which are separated by the pulp ends. Connective tissue of the pulp cords is a derivation of the mesenchyme, but the origin of the various type of cells in the cords is not certain. The adventitia of the walls of some small arteries become infiltrated with lymphocytes to form the splenic corpuscles.

The spleen is a blood forming organ, in which leukocytes and, in embryonic life as well as, under certain conditions, in adult life, erythrocytes are formed.

It is situated under the cover of the lower ribs, in the posterior portion of the left hypochondriac region, being separated from the ribs by the diaphragm, and above by a small portion of lower margin of left pleura and lung, so that its position corresponds to the 9, 10, 11th ribs. Its upper and inner extremity extends into the epigastric region, being distant about 1½ inches from median plane of the body, while its outer end reaches almost to the mid axillary line. It is obliquely placed between fundus of stomach and diaphragm, its obliquity runs first from above downward and outward and also from above downward and forward, following the direction of the 10th rib.

It is the largest of the so-called "Ductless Glands" and varies greatly in size, its average length being about 5″, width about 3″ and its thickness about 1 to 1¼″, and weighs about 6½ oz. Furthermore, the size of the spleen is increased during and after digestion and varies considerably according to state of nutrition of the body, being large in well fed, and small in starved animals.

The spleen is normally movable within certain narrow limits. It moves with respiration and also with the stomach movement. It is supported by ligaments which are folds; the gastro-splenic omentum which is a fold of peritoneum connecting the margins of the hilum of the spleen to the stomach, the lieno-renal liga-

ment which is derived from the layers of peritoneum forming the greater and lesser sacs when they come in contact between left kidney and spleen. It is also held in place by the phrenocolic ligament. The spleen is of an oblong, flattened, tetrahedral form, soft, of very friable consistency, highly vascular and of a dark purplish color.

It has four surfaces, upper and lower ends, and three borders.

The external or phrenic surface is convex, smooth, and is directed upward, backward and to the left. It is in relation with the under surface of the diaphragm, which separates it from 9, 10, 11th ribs of the left side, and the intervening lower border of the left lung and spleen. The internal surface is concave, and is divided by a ridge into an anterior or gastric, and a posterior or renal portion. The anterior or gastric, which is directed forward and inward, is broad and concave, being in contact with the fundus of the stomach, and below this with the tail of the pancreas. It presents, near its inner border, a long fissure, called the hilum, in which are several irregular openings for the entrance and exit of vessels and nerves. The posterior or renal surface is directed inward and downward. It is somewhat flattened, considerably narrower than the gastric surface, and is in relation with the upper part of the outer surface of the left kidney and occasionally with the left suprarenal gland.

The upper end of the spleen is directed inward toward the vertebral column, where it lies on a level with 11th thoracic vertebra within 1½-2″ of the midline. The lower end, sometimes called the basal surface, is flat, triangular in shape and rests upon the splenic flexure of the colon and the phrenocolic ligament and is generally in contact with tail of pancreas.

The anterior border is free, sharp, and thin, and is often notched, especially below. It separates the phrenic surface from the gastric surface. The posterior border, more rounded and blunter than the anterior, separates the renal from the phrenic surface; it corresponds to lower border of 11th rib and lies between diaphragm and left kidney. The internal border or intermediate margin is the ridge which separates the renal and gastric portions of the internal surface.

The spleen, with the exception of its hilum, is completely invested in peritoneum, which is firmly adherent to the capsule

of the organ. The capsule of the spleen consists of connective tissue, elastic fibers and nonstriated muscle cells. This capsule sends numerous processes or trabeculæ into the interior of the organ, which branch and form a frame work in which the vessels, especially the veins, are embedded.

On examining a section of the spleen with the low-power magnifying glass, sections of the trabeculæ, round or oval masses of cells, similar in structure and appearance to the lymph nodule, called Malphigian corpuscles, are clearly defined. Between and around these structures is a tissue rich in cells, blood vessels and blood-corpuscles, known as the spleen pulp. The Malphigian corpuscles or bodies are not very plentifully represented in man, and they are, with their germ centers, the formative centers for the lymphocytes.

F. P. Mall, whose contributions on the structure of the spleen have greatly extended the knowledge of the microscopic anatomy of this organ, states that the trabecular and vascular systems together outline masses of spleen pulp, which he has named spleen lobules. Each lobule is bounded by three main inter-lobular trabeculæ, each of which sends three intra-lobular trabeculæ into the lobule communicating with each other in such a manner as to divide the lobule into about ten smaller compartments. An artery enters at one end of the lobule and passing up through its center gives off a branch to the spleen pulp found in each of the ten compartments formed by the intra-lobular trabeculæ. The spleen pulp in these compartments is arranged in form of columns or cords called *Pulp cords.* The branches of the main intra-lobular artery going to each compartments divide repeatedly; the terminal branches course in the spleen-pulp cord and in their path, give off numerous small side branches, which end in small expansions known as the *Ampullæ of Thomas.* These are divided into three parts, the first part, the ampulla proper, is lined by spindle shaped cells, directly continuous with the endothelial cells of the artery, the 2d third, which often communicates with neighboring ampulla, contains large side openings, while the remaining third is difficult to demonstrate. The circulation through spleen is therefore not a closed one, through a system of capillaries completely closed, but rather through spaces in the spleen pulp certain of which are

more direct, leading from the terminal arteries to the veins.

Therefore, the spleen has a very typical blood supply. The splenic artery, which is a branch of coeliac axis, enters the hilum and divides into branches that follow the trabeculæ. Of these, some quickly pass to the pulp, while others follow the trabeculæ to their smallest divisions, that is, to the ampullæ of Thomas. These ampullæ are porous and continue as veins, that collect the blood and empty it into the splenic vein at the hilum.

The lymphatics originate in two ways, each from the sheath of the arteries and in the trabeculæ. The former trunks are the deep collecting trunks, and accompany the blood vesesls, the latter pass to the superficial lymphatic plexus, which may be seen on the surface of the organ. Lymphatic channels do not exist in the pulp. The deep trunks at the hilum number from 1-10 and terminate in the splenic node. The superficial trunks also pass to the hilum and terminate in the splenic nodes. The nerves are derived from the splenic plexus, which is a part of or connected with the solar plexus. Nerves enter the spleen with the vessels.

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EIGHT

The Physiology of the Spleen

BY

ADOLPH S. KRAMER, PH. G., B. S., CLASS OF 1917.

THE importance of the functions of the spleen have not been given until recent years their due attention. The spleen is the largest ductless gland in the human body, and as other similar glands, it has undoubtedly a multiple function. However, literature on physiology in general, and our text books especially, have until lately concerned themselves mostly with the more obvious and easily detectable functions of this organ, and have semingly entirely neglected the more obscure and complicated ones, the latter being most probably due to the internal secretion possessed by the spleen.

It is accepted that the spleen, like the lymph nodes, is engaged in the formation of white blood cells, this being well confirmed, first, by the fact that there is an increase in the white count, after passing a current over the area enclosed by the surface marking of the spleen, and, second, by the fact that the splenic vein contains a larger amount of white blood cells than the splenic artery.

The spleen also acts as a filter for the blood, retaining debris, and different particles found in the blood that would be injurious to health, if not removed.

It is also well established that the spleen, during intrauterine development, is concerned in the production of red blood cells, as during that period the spleen contains many red blood cells in different stages of development.

Again, the presence of a large amount of products of destruction of red blood cells in the spleen, and the considerably smaller amount of red blood corpuscles in the splenic vein, than in the splenic artery, proves the long held view that the spleen breaks down the red blood cells, which have discharged their office and are worn out.

Besides these obvious functions, the spleen undoubtedly has an internal secretion, the functions of which are quite numerous and complicated, hence more or less difficult to determine.

In this paper I will endeavor to abstract the most important work done by different investigators in this field, and also add some of my own observations, which though amounting to very little, as compared with the tremendous work done by many scientists, yet may be of some value.

The four methods to study the functions of an organ, having an internal secretion, are to note the changes taking place during:

(A) Diseased condition of the organ.

(B) Extirpation of the organ.

(C) Transplantation of the organ after extirpation.

(D) Injection of the extract of that organ.

Of these the second and fourth are of importance, as far as the study of the functions of the spleen is concerned, since diseases of the spleen are almost exclusively secondary, thus eliminating the first method and, as a short time after removing the spleen, other glands, especially the lymph nodes, take up the most important functions of this organ, transplantation does not seem to have a noticeable effect.

The fact that splenectomy is not incompatible with maintenance of life led some physiologists to doubt that the spleen had an internal secretion, but the numerous investigations recently conducted by many great physiologists prove it beyond any doubt.

The functions of the spleen attributed to its internal secretion may be grouped into three general classes:

(A) Those affecting the gastro-intestinal tract.

(B) Those influencing the general resistance of the individual.

(C) Those affecting the composition of the blood.

To the first group belong the experiments of:

(1) Richet,[1] who, after a series of experiments, concludes that the spleen by mechanism not well explained, facilitates the absorption and assimilation of food. He splenectomized nine dogs and made careful comparative observations, with nine other dogs, as similar as possible in age, sex and disposition. The result showed that the splenectomized animals ate more, but gained in weight less than the normal ones, though before splenectomy they gained about the same amount as the other

animals, and he concluded that the spleen plays an important role in the assimilation and digestion of food.

(2) Bellamy's[2] observations of human beings, who were splenectomized on account of different blood diseases, corroborated Richet's assumption and partly explains it. He found that the pancreatic digestion in such people is almost invariably lost, and that most of the intestinal digestion is carried on by the succus antericus lower down, thus reducing the area of absorption and limiting the amount of digestion.

(3) Herzen[3] proved, experimentally, what was afterwards duplicated by Bellamy—that the spleen, by an internal secretion, carried through the blood to the pancreas activates the trysinogen into trypsin, but this, while mostly performed by the spleen, is not limited to the latter, as the jujenal mucosa, especially the lower half, furnishes a similar activator.

(4) Luciani,[4] of the University of Rome, proved, experimentally, the influence of the spleen on gastric digestion. After removing the spleen he found the digestive power of the gastric juice slowly, but constantly weakening, and after administering, by mouth, an infusion of congested spleen, eight hours before a test meal, the digestive power was again raised for one to two days.

(5) Retger and Mandel[5] proved that an injection into the circulation of the splenectomized dog of an aqueous solution of splenic extract increased the secretion of trypsin from the pancreas.

(6) Prof. Ott[6] observed that the peristaltic movement of the gastro-intestinal tract was considerably impaired in splenectomized animals, and that same was restored to normal after injection of splenic extract.

To the second group belong the experiments of:

(1) Dr. R. C. Carpenter,[7] who, concluding from the fact that the spleen becomes greatly enlarged during acute infectious diseases, that it is a source of a protective substance, gave to his typhoid fever patients splenic extract (five grains, three times a day) in order to restore the functions of that organ, which is greatly disordered in typhoid, and, according to his clinical records, the temperature of the patients so treated was considerably reduced and was followed by a general amelioration of symptoms.

(2) Sajous[8] explains the great protective value of the spleen in the following manner: The power of the leucocytes to destroy micro-organisms depends upon the presence of trypsin in them. This trypsin is supplied by the pancreas in the form of the inactive trypsinogen, and is activated by a substance secreted by the spleen, thus enabling the leucocytes to digest the pathogenic micro-organisms, hence increasing the individual's resistance.

(3) Dr. Boyle,[14] of Conner, treated a number of tubercular patients with a specially prepared splenic extract, and in his communication to The International Congress of Tuberculosis, at Rome, in 1912, claimed wonderful results, as not only does it increase the number and efficiency of the phagocytes, but it also stimulates the individual cells to combat the Koch bacillus. In one hundred and forty-six cases, out of the hundred and fifty so treated by him, there was an unquestionable rapid effect of the treatment, and out of those that received a prolonged treatment seventy-five per cent. were absolutely cured. The preparation used by Boyle is an extract of the pig's spleen, known as Colloidogenine. According to Boyle, one of the functions of the internal secretion of the spleen is to keep the principal mineral salts in the blood in the colloidal form, as according to him only colloids are suitable for cellular appropriation, while crystoloids are waste and are eliminated by the kidneys. Boyle proved this theory by greatly reducing excessive elimination of phosphates in urine with one or two doses of his splenic extract.

Besides keeping the salts in a form easily appropriated by the cells, thus enabling them to resist the action of the tubercle bacillus, the splenic extract seems to greatly stimulate the growth of connective tissue around tubercular lesions, thus walling them off from the surrounding tissue. Two similar guinea pigs were inoculated with tuberculosis, one was treated with splenic extract, and the other not. The former survived, and nine months later, when killed, showed, on autopsy, that all tubercular lesions were completely overgrown with connective tissue, while the second guinea pig, not treated with splenic extract, died three months after inoculation, and on autopsy showed no tendency to fibrosis.

To the third group belong the investigations of:

(1) Pugliese,[9] of Milan, who proved by series of experiments the role the spleen plays in keeping up the normal amount of pigments in the blood and bile. He investigated the secretion of bile in the same animal before and after splenectomy. The volume of the bile was increased, but the total output of iron was decreased, while the amount of iron in the feces was considerably increased. He also demonstrated a diminution of iron in the blood, and along with it a decrease of red blood cells. This is only true of the early period of the removal of the spleen, the blood soon returning to normal, if the animal is fed on an iron rich diet (much meat).

(2) Asher,[10] of Berne, by comparative observation of a splenectomized and a normal dog, found that the former excreted more iron in the feces with same diet. He also found that while the normal dog did not show any signs of anemia after a prolonged iron free diet, the splenectomized dog showed marked anemia under same conditions.

Bayer,[11] having observed splenectomized people, found same to be true of human beings, hence we can justly infer that the spleen in some way or other enables the body to maintain ingested iron.

(3) Donilesky[12] and Selensky, as far back as 1895, proved, experimentally, that when the extract of spleen is administered hypodermically, it considerably raises the hæmoglobin contents (7-40 per cent.), as well as the number of red blood cells.

(4) Simon's[13] and Spillman's experimental findings show that an injection of .2 gram of freshly prepared splenic extract caused an increase of red cells from 2,980,000 to 6,810,000, while the white count, at the same time, was raised from 9,400 to 12,800.

(5) Boyle,[14] after injecting 5 c.c. of his extract in a tubercular patient with a red count of 3,800,000, increased same to 5,000,000 in twenty-four hours, and after a second injection, twenty-four hours later, to 6,000,000.

(6) Dr. David,[15] using splenic extract in anemia, found that not only the blood findings were changed, but the appetite was improved and there was a considerable increase in weight, as well as general health of the patient.

Dr. Carnot explains the increase of the red cells by the fact

that the splenic extract stimulates the red bone marrow in same manner as the thyroid extracts stimulate the activity of the ovary, that is, the spleen has a synergic action.

These experiments constitute only a small number of those recorded in medical and physiological literature, but are sufficient to show the importance of the spleen and usefulness of its extract in different pathological conditions.

As mentioned before, I myself have conducted a few experiments and will here give the results of one of them in detail.

The fifth of November, 1915, I procured a dog and kept him under my observation for one month, feeding him on the following diet:

Per twenty-four hours: Meat, one-half pound; bread, one-half pound; water, one pint.

He gained, the first week, one and one-half pounds, then from three-quarters to one pound per week. At the end of the month I took his blood count, with the following result:

R. B. C. 5,000,000, of which only a few were nucleated.

W. B. C. 8,200.

Blood platelets, few.

I then removed the spleen, observing at the same time his musculature and the amount of fat in the internal organs. The former being well developed, and the latter being more or less scanty. After the operation I fed him for a week on a liquid diet, consisting of milk mostly. During this week he lost three and one-half pounds. At the end of the first week his temperature and general behavior became normal. I then started to feed him on the same diet as before the splenectomy, but he became very restless. I attributed his restlessness to hunger, and increased his meat ration to one pound per day. At the end of the second week he gained four ounces. During the third week he lost two ounces, and during the fourth week he gained seven ounces, but his muscles became flabby. During the fifth week he gained only two ounces, his muscles becoming more flabby than before. I then mixed with his food splenic extract (ten grs., three times per day) and cut down his meat ration to three-quarters of a pound. He began to regain his weight the first week, four ounces, and from five to six ounces the succeeding three weeks. Later, when I had eliminated the splenic extract

he only gained about one ounce in two weeks. I then made another blood count and found his red to be 3,800,000, but fully half of them were nucleated cells. The white count was 8,900, the differential count showing only a slight change. There was some increase in large mononuclear leucocytes. The great change in the kind of red corpuscles can only be explained by the fact that the bone marrow was not stimulated sufficiently to produce a mature red blood cell.

I then killed the dog and found, on autopsy, that there was great increase in fat, but a decrease in muscle tissue. The internal organs, macroscopically, hardly showed any change except the lymph nodes, which were considerably enlarged. Microscopically the mesenteric lymph glands showed, on section, a great increase in lymphatic tissue. The most interesting microscopic picture was that of the pancreas. It was tremendously granular, the granulation being so pronounced as to completely obscure the cell islands of Langerham. My opinion is, that intense granulation of the pancreas is due to the fact the spleenless dog's pancreas does not discharge so easily, if at all, its trypsinogen, and the granules of trypsinogen are retained which are seen on section.

I intended to perform a number of other experiments, but as the facilities and my time were very limited I had to postpone them till a more favorable occasion.

From the above stated facts you can summarize that the functions of the spleen are:

(1) Production of R. B. C. during intrauterine development.
(2) Production of W. B. C.
(3) Filtration of the blood.
(4) Destruction of old unfunctionating R. B. C.
(5) Aids assimilation and utilization of food.
(6) Activates trypsinogen into trypsin.
(7) Raises digestive power of gastric juice.
(8) Stimulates pancreatic secretion.
(9) Regulates the amount of pigments in blood and bile.
(10) Aids peristalsis of gastro-intestinal tract.
(11) Increases general resistance.
(12) Prevents the decolloidization of salts in the blood, thus retaining them in the blood in a form that they can be appropriated for cellular activity.

(13) Stimulates the production of C. T., especially around lesions.

(14) Raises hemoglobin contents in the blood.

(15) Stimulates red bone marrow to produce R. B. C.

The last two increase the oxygen carrying power of the blood, thus increasing oxidation of deleterious products.

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Injuries and Ruptures of the Spleen

BY

JOHN W. PANGBURN, JR., CLASS OF 1917.

FROM the surgical standpoint this organ receives, probably, the least amount of attention of all the abdominal viscera, yet there are few emergencies of more serious import in abdominal surgery than the hemorrhage from a lacerated or ruptured spleen.

Etiology.—While these conditions, namely, lacerations and ruptures of the spleen are not common, neither are they rare, but since they are of such serious nature in themselves and because they are usually complicated with other abdominal injuries they merit careful consideration. A diseased spleen or a congestion of the spleen, as occurs in all acute infectious diseases, is predisposed to these accidents. Perhaps the most frequent causes of injuries to the spleen are stab wounds and these are usually multiple, the injury to the spleen occurring through the thorax rather than through the abdomen in most cases. Stassoff[1] reports nine such cases. In these cases there is always an associated diaphragmatic and pleural wound of variable extent. Again, we may have injuries of the spleen occurring through the abdomen, as in the case of a gunshot wound. Compression of the abdomen may cause splenic lacerations or rupture and such compression may occur by the passing of a wagon wheel over the abdomen, Chanier and Bardon[2] having reported such a case.

Perhaps the rarest type of these cases is the spontaneous rupture of a tubercular spleen, a case of which has been reported by J. E. Cannaday.[3] Still another rare case of this type is the rupture of an enlarged spleen during an epileptic fit, a fatal case of which has been reported by L. Norrlin.[4]

Lastly, fatal ruptures have also occurred during coughing and straining spells or from falls or blows upon the abdomen.

Anatomy in Brief.—The spleen measures 5x3x1½ and weighs about seven ounces, hence it is quite a large viscus.

It lies deep in the left hypochondrium, under the 9-10-11th ribs, and is connected with the stomach by the gastro-splenic

omentum, with the diaphragm by a suspensory ligament and with the left kidney by the lieno-renal ligament, all of which are folds of peritoneum. It is covered by a fibro-elastic capsule from which septa radiate into its substance forming its stroma. It is supplied by the splenic artery, a large vessel which divides into five or six branches as it enters the hilum.

Lesions.—The gross lesions found in these cases are quite varied, but the result is about the same in all cases, namely, that of severe internal hemorrhage.

We may find single or multiple partial ruptures of the capsule and medulla. We may find a spleen more or less completely broken into two or more pieces. Again we may find the external capsule alone ruptured. Cases have been reported in which the spleen itself has been injured without rupture of its capsule, but followed by a secondary hematoma and rupture. Other varieties of splenic injury are seen in those cases where the spleen is severed from its pedicle or has been reduced to a pulp within its capsule.

Complications.—With injuries of the spleen there is generally more or less involvement of the adjacent viscera giving rise to varied surgical emergencies of grave import. Isolated wounds of the spleen are only apt to occur in normal spleens when the diaphragm is fixed in deep inspiration at the moment of the injury. In stab wounds the pleura and diaphragm usually show variable injuries. In cases of bullet wounds the stomach may be involved.

Norrlin[4] reports a series of cases of rupture of the spleen among which are the following complications. Each of the cases here mentioned is designated by its complication:

A case associated with injury to the liver and ventricles.

A case associated with injury to the diaphragm.

A case associated with injury to the small and large intestines.

A case associated with injury to the splenic vein.

A case associated with injury to the lungs and fracture of the ribs.

Four cases associated with fracture of the ribs.

Prognosis.—The prognosis is uncertain in all cases, the more so since the extent of injury is so variable and complications are

the rule. In those cases where the splenic injury is accompanied by injuries of the diaphragm and pleura only, the prognosis is fairly good, if operated immediately, the mortality being about eighteen per cent.

In the rare cases of rupture due to a primary tubercular lesion the prognosis is poor since the condition is rarely diagnosed early enough to obtain good operative results and secondary tubercular lesions of some other viscus is apt to ensue.

Lastly, in all these caess complicated by injuries of other abdominal viscera the prognosis is necessarily more grave.

Symptomatology.—The complications in these cases render the symptom complex unsatisfactory for diagnostic purposes so that an exploratory laparotomy is necessary. The most important symptoms are those of internal hemorrhage, namely, rapid thready pulse, subnormal temperature, cold clammy sweat, great thirst, blanched lips, dilated pupils, dyspnea, etc. The abdomen is apt to be rigid and tender. Pain throughout the affected side, and in some cases violent pain is felt in the left scapular region, this latter being known as Kehr's sign. Signs of trauma are generally present, but still cases occur which show no outward signs at all. Most cases give a marked percussion dulness, which is generally unilaterally left. This is explained by the coagulation of the extravasated blood in the left flank and is more or less characteristic of hemorrhages of the spleen.

Treatment.—Immediate operative procedure is always indicated, care being taken to maintain the body temperature by external applications and aggressive measures used to combat shock—the latter are too well known to be mentioned here.

The procedures most often adopted are partial or complete splenectomy and splenorrhaphy; probably complete splenectomy is the most frequent used of these.

W. J. Mayo[5] says "that safety in splenectomy depends on the careful separation of the attachments of the spleen and the delivery of the organ without injury to its vascular pedicle." He gives the following technic for the operation. Make a longitudinal incision through the upper half of the left rectus muscle—this part of the incision may be carried downward to any desired extent. From the upper end of the first incision an oblique incision is made along the costal margin and about an

inch and a half from it which is carried up toward the ensiform. Vascular adhesions, especially near the upper pole of the spleen, are apt to be encountered; carefully separate them with the fingers, as close to the spleen as possible. Occasionally such adhesions are very resistent and require cutting for their separation. The bulk of the vascular supply is in the gastro-splenic ligament, which can be delivered with the spleen, the stomach being partly withdrawn from the abdomen before the gastro-splenic ligament and vessels are separated.

In cases of large adherent spleens there may be deep vascular connections with vessels running along the spine and crux of the diaphragm; these, of course, must be separated before the spleen can be removed. In such a case the hemorrhage is controlled by carefully adjusted gauze tampons, since the bleeding points cannot be seen before the removal of the spleen. When the tail of the pancreas is involved it is separated and its bleeding points are ligated. Now the vascular pedicle is cleared and ligature applied by the two forceps method, arteries being taken first. W. J. Mayo[5] reports five deaths in fifty-six such cases and two of the five fatal cases were septic.

Stassoff recommends splenorrhaphy for these cases. In this operation the splenic laceration is sutured with catgut and the line of sutures is overlaid with omentum. He warns against tamponade for the reasons that it is impossible to completely close the wound, because of the liability to infection of the fistula and because of the tendency to secondary hemorrhage.

In partial splenectomy only the injured part is removed and the edges of the residue brought together with sutures.

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Wounds and Rupture of the Spleen

BY

H. C. Lyman, Class of 1917.

AS compared with lesions of other parts of the body, due to injury, lesions of the spleen are very rare, and comparatively few cases have been reported.

Wounds of the spleen are generally caused by gunshots or stabs. Splinters of wood may also pierce the abdominal wall and injure the spleen. In these cases the spleen alone may be affected, but generally other viscera as well are involved. From whatever cause, an external wound will be seen. The individual will collapse and in a short time may pass into the state of unconsciousness. There may or may not be vomiting of blood. The abdomen will usually be found to be somewhat distended on the left side, and the abdominal muscles will be rigid, especially the left rectus. Upon percussion, the splenic area will be enlarged, the dulness may extend to the left flank. In a number of cases it may be found that the dulness, which is due to hemorrhage, may extend over the entire abdomen. This is diagnostic of internal hemorrhage only, and calls for immediate surgical interference.

Generally the spleen is involved to such an extent that excision of the organ is the best treatment.

More common and less serious than wounds of spleen is rupture of spleen. This is due to blunt objects striking the body in the left hypochondriac region below the ribs or above the ribs, with fracture of the same. Vehicles passing over the body in the splenic area may cause rupture, or blows to the right side of the body may rupture the organ by contracoup. Rarer by far is that form of rupture occurring in falls in which the individual strikes on his feet. Individuals suffering from malaria, typhoid and pernicious anemia are predisposed, due to the splenic enlargement, and in these cases rupture frequently occurs. In these cases the rupture may appear spontaneous, but slight violence has probably been overlooked.

The lesions vary greatly. The capsule may remain intact, and small hemorrhages will infiltrate the parenchyma with subsequent enlargement of the organ, or the spleen may be divided into two or more parts, and thus involve the vessels at the hilum. The lacerations take on various shapes, small or large, regular and clean cut, irregular and jagged, or stellate. The hemorrhage varies with the extent of the lesion. If large in amount the symptoms are produced immediately, while if small the hemorrhage will be small and may remain pocketed. In such instances the symptoms will not be marked in twenty-four to seventy-two hours.

In well marked cases with the history of trauma there will be the anxious face, pallor, and a feeble, rapid pulse. The individual will complain of pain in the left hypochondriac region. This pain is constant and increases in intensity. The patient suffers from shock and, as the pain increases, shock becomes more intense. The abdomen is usually enlarged on the left side and high up. There may or may not be vomiting of blood. Thoracic breathing is marked. There is considerable tenderness over the splenic area, the abdomen is usually rigid, especially over the left rectus muscle. The spleen becomes enlarged and the area of dulness, due to the hemorrhage, may extend to the left flank. With the stethoscope on the abdominal wall, and by gently depressing the wall, friction sounds which are very weak may be heard. The sounds are produced by the clots of blood coming in contact with the abdominal wall.

With the shock and the pain Eliot lays great stress on the amount of costal resistance and force encountered in depressing various segments of the costal arch toward the vertebral column. The temperature in these cases rarely exceeds 102°, while the pulse varies from 100 to 150, and the respirations from 30 to 40.

The mortality, according to Berger, is 92.3 per cent. in unoperated cases, while by every operative procedure the mortality is below 40 per cent.

Of the methods of treatment, namely, suturing, tamponade and splenectomy, each has its adherents. Suturing is unreliable in the stopping of hemorrhage because of the ease with which the splenic tissue tears. Tamponade has been used with great success. Ross has reported six cases collected by him in which

there was one death. It is best used in those cases in which the wound is slight, where quick work is necessary to save the patient, and where, due to adhesions of the organ, splenectomy is contra-indicated.

With splenectomy the death rate is rather high (34 per cent.), but the stopping of hemorrhage is sure, and patients recovering seem to suffer no bad effects from the loss of the organ.

An incision is best made over the point of greatest tenderness, the pedicle, with its vessels, is ligated and cut and the organ removed. All clots are removed from the abdomen, and it is thoroughly irrigated with hot saline. The wound is closed except at its lowest portion, layer by layer, and drainage is instituted.

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TWENTY-FOUR

The Relation of the Spleen to Blood Diseases, From the Surgical Aspect

BY

F. A. Cummins, Class of 1917.

THE field of surgery in diseases of the blood and spleen is at present a matter of considerable discussion. Up until the present time the subject has received little attention, and even now the arguments for or against surgical intervention are based simply upon the results of the comparatively few operations which are recorded.

The close relation between the spleen and the blood is well known. Since the spleen is credited with the power of breaking up the dead or dying red blood cells, it is evident that an exaggerated function may be an important cause in the production of the various forms of anemia. The destruction of red blood cells may be due to simple over-activity of the spleen, or may be the result of parasitic infection of the spleen, but in either case the results are much the same.

Now to take up the more common blood diseases, somewhat in detail, we can simply give the opinions of different authorities upon the diseases themselves and their results from surgical treatment.

Pernicious Anemia.—It is really undecided just what part the spleen plays in this disease. Dr. Hunter claims that pernicious anemia is essentially hemolytic in nature, and that the destruction of red blood corpuscles occurs in the portal system, and is due to toxins absorbed from the alimentary canal. How does the spleen play any part in this hemolysis? It contains an increased amount of altered blood pigment, but may this not be deposited there by the blood? He says there is no reason to believe that the disease is due to any primary changes in the spleen. On the other hand, Drs. Harpole and Fox, of Chicago, report a case of pernicious anemia which, under medical treatment, was rapidly growing from bad to worse. Associated with the other symptoms of the disease the spleen was greatly enlarged, easily palpable and sug-

gested over-activity. A splenectomy was finally done. The spleen was found to be twice its normal size, and the pathological report was chronic splenitis. Since the operation the patient's blood count has shown a great increase in number of red corpuscles and the general health has returned to normal.

A report from the government hospitals of the Argentine Republic shows two such cases operated with death in each case.

Dr. Roblee, of Riverside, Cal., also reports upon two cases of pernicious anemia which he treated by splenectomy. In both cases the red blood count was greatly increased, and one of the cases in particular showed marked improvement generally. He has been led to believe, however, that splenectomy does not guarantee a complete cure, but will invariably bring marked improvement.

HEMOLYTIC JAUNDICE.—The usual symptoms of hemolytic jaundice are chronic jaundice, anemia, enlarged spleen and an excess of urobilin in the urine and feces. The disease usually commences in childhood, the severity does not increase with age, but the condition is subject to frequent exacerbations. The hemoglobin content of the blood is lowered, the serum is bile tinged and the red corpuscles are more or less diminished and extremely fragile. The spleen is greatly enlarged but not tender.

Normally the bile is formed by the phagocytes of the liver and spleen taking up the dead and dying blood cells. The hemoglobin thus liberated is absorbed by the hepatic cells, iron is split off and bilirubin is excreted into the bile capillaries. Adami regards jaundice as a regurgitation of bile pigment into the blood and lymph stream, from a surplus of the pigment in the liver. Through increased hemolysis the spleen produces bilirubin in excess; or beyond the power of the hepatic cells to dispose of, and jaundice results. So it seems that this disease is due to excessive destruction of red blood cells, and the spleen appears to be the seat of over-activity. Now to cite a case operated by Dr. Kanaval, of Chicago. The patient was a man 54 years of age, who had suffered from more or less jaundice for forty years. He had numerous attacks of headache, aching in the muscles, tenderness in the upper abdomen, marked jaundice, anemia and splenic enlargement. The blood count showed reds, 5,000,000; whites, 4,500; hemoglobin, 70 per cent., and a coagulation time of 3.2 minutes. The red cells were markedly less resistant to hypotonic

salt solution. After splenectomy the jaundice slowly but entirely disappeared and the general health has greatly improved.

Examination of the spleen showed increase in size, probably due to congestion and infiltration and a marked atrophy of the malphigian corpuscles and the splenic pulp. This and other successful operations for hemolytic jaundice indicate that the spleen plays the chief part in the pathogenesis of the disease.

Malarial Disease of the Spleen.—In malaria the spleen is decidedly affected. The importance of the relation of the spleen to the disease lies in the pathological changes of the organ and their results. The changes in the spleen may be roughly confined to:

1. Marked proliferation and deposition of pigment.

2. Obliteration of vessels and resulting atrophy of the parenchyma.

3. Greater consistency.

4. Size greatly increased, causing functional disturbances of the other organs by pressure, also inflammations and adhesions.

The chief danger lies in the possibility of tortion of the pedicle and the resulting acute and chronic effects. Blood cysts and hemorrhages within the capsules often occur. Splenectomy is the only advisable surgical treatment in these cases.

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The Spleen and Its Relation to Blood Diseases

BY

F. Fay Williams, Jr., Class of 1917.

I WILL take up, first, leukemia, of which two forms are distinguished; though the distinction is chiefly a clinical one.

(a) Myelogenous leukemia. (b) Lymphoid leukemia.

Taking first myelogenous leukemia:—This form of blood disease is particularly interesting because of the wonderful variety of the blood-film. The disease consists primarily of an enlargement of the spleen and other blood making organs with an excess of white corpuscles; the count often running as 250,000 per cubic milimeter.

The differential count shows extraordinary types, including many not seen in ordinary blood; there may be myeloblasts, which appear to be a reversion to the ancestral type of myelocytes; eosinophilic myelocytes are also found and are considered diagnostic of myelogenous leukemia.. Mast cells are more numerous than in any other disease, running as high as 12 per cent. and the normoblasts are usually very numerous.

Because of the fact that all the other blood making organs are involved splenectomy has little effect on the disease. The best form of treatment seems to be the X-ray.

Taking next Lymphoid Leukemia.—This form of leukemia is very rare. There are numerous theories advanced as to its cause, but the most plausible one seems to be that it is a disease primarily of the lymph glands with a secondary metastasis to other organs.

There is a rapid production of white blood corpuscles of the ancestral type with the lymphoid variety predominating over the myelocytes. The leucocytosis may run as high as 40,000 to 80,000 or as low as 471 per cubic millimeter; with this you will find a lymphocytic percentage running from 90 to 99.9. The red cells are often reduced to as low as 2,000,000 with the hæmoglobin percentage practically corresponding to the corpuscle per-

centage and the color index remaining normal. The splenic pulp becomes converted into a mass resembling bone marrow.

The treatment is not very satisfactory, but consists of fresh air, diet and abstaining from mental worry; the X-ray has been used but with very little success. Excision of the leukemic spleen has been performed, but with small percentage of success.

Banti's disease or splenomegaly with hepatic cirrhosis is a peculiar disease, which, though it resembles primitive splenomegaly, splenic anæmia and Gaucher's disease gives a somewhat different picture. That the spleen is itself at fault appears probable from the prompt relief which follows its removal.

The disease is manifested in three pathological stages:

1. Simple enlarged spleen without anæmia or perhaps only a low color index.

2. Severe secondary anæmia with pigmentation of the skin and a tendency towards hæmatemesis.

3. Finally cirrhosis of the liver, jaundice and ascites.

Banti believed the disease was due to an unknown infective agent setting up changes of a non-inflammatory character; this agent being carried by the blood to the spleen and causing a degeneration of the splenic pulp and follicles with hyperplasia of the reticulum. A second theory is that the primary disease lies in the spleen and the toxins are liberated into the blood. Another theory is based on the fact that normally the endothelial cells of the spleen ingest old red blood cells and that through loss of vasomotor control of the splenic artery—due to disease of the visceral sympathetic ganglion—causing overfilling of the spleen, this results in hyperplasia and increased functional activity, in consequence of which the endothelial cells destroy both diseased and healthy red blood corpuscles. To substantiate this theory the fact is known that as soon as splenectomy is performed the hæmolysis is stopped and a rapid regeneration of erthrocytes and hæmoglobin is the result.

Age, sex, race nor country does not seem to have any bearing on the disease.

Pathologically the spleen is enlarged, but retains its normal shape and appearance. Usually there are found numerous perisplenic adhesions, and the capsule and fibrous trabeculæ are considerably hypertrophied. The splenic vein shows sclerosing endophlebitis and often calcification and stenosis.

Symptoms of the first stage are of insidious onset and of long duration with progressive painless enlargements of the spleen and subjective symptoms of weight and discomfort in the left hypochondrium. In the second stage the early symptoms are simply those of anæmia, *i. e.,* pallor, weakness, dyspnea and palpitation. The blood is of the chlorotic type with a diminution in red blood cells under 4,000,000, hæmoglobin as low as 40 per cent. and color index very low; also get a leukopenia with a relative lymphocytosis. The urine is diminished and contains urobilin and albumen. The liver is large, smooth and painless. Hemorrhages from the stomach, nose and gums are now apt to appear.

The onset of the third stage is characterized by the development of ascites, the fluid of which has the appearance of a transudate. The liver is now diminished in size and you get an aggravation of the gastro-intestinal symptoms, also the skin becomes very much pigmented.

Diagnosis in the early stages is impossible and because of the comparative simplicity of splenectomy many of the diseases that might be confused with Banti's disease are treated in this way, but the operation must be done in the early stages.

HÆMOLYTIC SPLENOMEGALY.

This is one of the rarer forms of disease and resembles both Banti's disease and hæmolytic jaundice.

It starts with a steadily enlarging spleen, which, however, strange to say, gives no subjective symptoms and often passes unnoticed. The patient seeks medical advice usually because of the anæmia; this varies in its intensity, the red cells may be as high as 4,000,000 or fall as low as 1,000,000; the color index below one; the hæmoglobin under 20 per cent. and the cells show anisocytosis, poikilocytosis and polychromatophilia; also their total hæmolysis may be as low as 0.35—showing greatly diminished resistence. The white count will vary from 4,500 to 12,000, but the differential count varies little. Next we get a slowly developing jaundice, the urine always contains urobilin and the feces are usually highly colored.

Medical treatment is absolutely useless; the only satisfactory procedure is early splenectomy.

In getting these few facts together I have quoted freely from Burnham's Hæmocytes and Hæmic Infections; Biedl's Internal Secretory Organs; Cabot's Physical Diagnosis; Todd's Clinical Diagnosis; Osler's Practice of Medicine; from The Abstract of Surgery, Gynecology and Obstetrics and from The Annals of Surgery.

Tumors of the Spleen

BY

W. Heinicke, Class of 1917.

TUMORS of the spleen may be considered as solid and cystic, the former being divided into benign and malignant; the latter into dermoid, parasitic and non-parasitic.

The benign tumors, which have been described, are fibroma, enchondroma, hemi- and lymph-angioma and adenoma, all of which are extremely rare and "practically never give rise to symptoms calling for a surgical intervention." Brewer.

Of the malignant tumors sarcoma and carcinoma, both primary and secondary, occur. The primary carcinomata usually are of the medullary type, occasionally of the melanotic variety, while secondary carcinomata usually follow a primary cancer of the stomach and are likewise of the medullary type. Sarcomata are, however, of more frequent occurrence and may arise in the capsule or in the trabeculæ. It is especially the primary sarcomata which are of surgical interest.

The first two cases were reported by Weichselbaum in 1881, both being post-mortem, and since then some 35 cases have been added. The varieties mentioned are the round-celled, the spindle-celled, the mixed-celled and the lympho-sarcoma, the latter more frequent.

Injury and previous attacks of malaria are mentioned in several cases as etiological factors.

In most instances there is a rapidly developing, hard, nodular tumor of variable size in the left hypochondrium, accompanied by severe abdominal pain, due to tension of the capsule, and traction of the ligaments. There is gradual wasting anæmia and emaciation. As the tumor enlarges, pressive symptoms develop, especially disturbances of respiration and of the function of the gastro-intestinal tract. Dyspnea is generally present. In other instances, however, the condition arises gradually. In one case reported by Doctor Hugh H. Trout: "Male, age 58, who, for

ten years had suffered attacks of severe abdominal pain. Maternal history of cancer, patient gave a life-long history of alcoholism and morphinism and had a traumatism of the abdominal wall years ago." Post operative examination showed a mixed-celled sarcoma. In another case reported by Mayo: "Female, age 41, married ten years, two children, youngest age 4. Attacks of malaria between the age of eight and ten. After birth of last child, patient noticed an enlargement in the region of the spleen, which disappeared and was not again noticed until seven months before examination. For six months previous to operation there had been some dyspnea, with anemia beginning at that time." Post-operative examination, lympho-sarcoma. Weight of tumor, 2.375 grams.

The diagnosis depends upon the history, the physical findings, the absence of any pronounced change in the blood, of fever and of fluctuations.

Treatment is splenectomy.

Prognosis.—In primary cases, if removed early, recovery is possible. Of sixteen cases of splenectomy three died early, five died of recurrence, and seven were alive after a period varying from six months to seven years.

Dermoid cysts are extremely rare, but one has been reported by Audral in 1829. This was centrally located.

Hydatid cysts are always unilocular, generally single, and commonly develop in the center of the spleen, producing a long drawn-out, bipolar organ.

The non-parasitic cysts may conveniently be classified according to their causes, as:

1. Traumatic cysts, hæmatoma and secondarily serous.

2. Infoliation cysts, inflammatory or traumatic inclusions of peritoneum. These are usually small, multiple and superficial.

3. Dilation cysts, due to a distention of the splenic sinuses.

4. Disintegration cysts, arising from arterial disintegration, as from emboli and resulting infarction and necrosis of the parenchyma.

5. Degenerative cysts or cystic degeneration of new growths.

Cysts are slightly more common in women between the ages

of 30 and 50. Malaria and syphilis are mentioned as causes.

The most frequently recognized cysts are the hemorrhagic, which are usually large, single, unilocular, most frequently subcapsular. Next are the serous cysts, which are generally multiple, some being small and superficial, others very large, containing as much as ten liters of fluid. These are located mostly on the anterior border and only occasionally upon the posterior border or convex surfaces.

The symptoms, when present, are those due to the large size of the cyst, *i. e.,* those of pressure, tension or from adhesion to adjacent organs. The most constant symptom is that of a heavy dragging pain in the left hypochondria or epigastric regions. Gastro-intestinal disturbances and interference with respiration may become quite marked.

Physical findings. A bulging in the left hypochondrium, which may or may not move with respiration.

Splenic tumor, which may be smooth, irregular or nodular; of a doughy or elastic consistency; movable or fixed. Tactile fremitus over splenic area may be present if adhesions to adjacent organs have formed.

On percussion a mass is found to be continued with the splenic dulness. Fluctuation is not always present.

Ascites is usually absent.

The diagnosis is made from the history, the rapidity of the growth, the physical findings and the character of the pain.

The treatment consists in splenectomy,[1] excision[2] or incision[3] and drainage.

Prognosis with early operation is favorable. In splenectomy 24 out of 27 recovering; in excision 4 out of 6. In suppuration or rupture it is unfavorable.

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THIRTY-FOUR

Wandering Spleen

BY

P. B. Jenkins, Class of 1917.

THE spleen, like the liver, is a floating organ, tethered by peritoneal ligaments. It moves with the diaphragm and in response to variations in the size of hollow abdominal viscera, and rarely in deformities of the spine, although it is not unduly movable in these cases. The term wandering spleen is applied to this organ when it is unduly movable. Synonyms are floating spleen—prolapse of the spleen—splenoptosis.

Etiology.—Wandering spleen may possibly be due to a congenital looseness of the ligaments, as it has been found in several members of the same family. It is rare except in women, those who have borne children being especially predisposed, and it usually accompanies a general visceroptosis, although it occurs in but 2 per cent. of these cases. Tight lacing may be a cause and it may occur secondary to movable left kidney, with consequent impairment of support. Prolapse of the spleen rarely occurs in a normal organ although it is possible that some of the diseased conditions found in wandering spleens are results and not causes. Moderate enlargement, especially the ague-cake spleen of malaria, predisposes to this condition. It may occur gradually after parturition with a general reduction of pressure and support or suddenly from trauma with resulting stretching or rupture of the ligaments. When from enlargement or a blow it slips off the supporting shelf of the phrenico-colic fold of peritoneum it drags on and stretches the gastro-splenic and lieno-renal ligaments. Ascites, pregnancy and abdominal tumors may force it upwards, while pleuritic effusions, pneumo-thorax and increased weight cause downward displacement.

Pathology.—There are two sets of pathological conditions which must be recognized—those the result of displacement and those independent of it, which are the morbid changes resulting from malaria and leukemia. Changes due to displacement are caused by a twisting of the pedicle and consequent interference

with the blood supply. The peritoneal pedicle, which may be a foot long, is easily twisted and, as the veins are more easily compressed than the arteries, engorgement results. This is demonstrated by the rapid diminution in size when the pedicle is untwisted at operation. As a result of this chronic passive hyperemia the vessels show obliterative changes and thrombosis, which lead to fibrosis and atrophy. This necessitates a gradual compensatory change in the lymphatic tissues elsewhere and is thought to explain the absence of symptoms when splenectomy is performed in such cases. When the torsion is more pronounced the blood supply is cut off, causing thrombosis and necrosis of the spleen.

Symptoms.—May be absent, the condition being then discovered accidentally at operation. Physical examination shows the spleen commonly in the left illiac fossa, less often in the umbilical region or right illiac fossa; in diaphragmatic and rarely in umbilical and inguinal hernial sacs. It varies in size according to the quantity of blood contained in it. The symptoms present in the average case are severe, paroxysmal pain, tenderness in the left hypochondrium, nausea and vomiting, a certain amount of shock, with increased pulse rate, and constipation. The patient complains of dragging and weight or discomfort in the back and abdomen. However, the most serious symptoms arise from complications.

Complications.—Twisting of the pedicle is practically always present and as many as six turns have been found. The resultant symptoms are severe, like those of ovarian cyst with twisted pedicle, and are those of acute peritonitis. It may cause thrombosis of splenic vein or necrosis of the organ with peritonitis. Rupture of the organ has occurred in these cases on every slight provocation. Perisplenitis may cause the organ to become fixed in an abnormal position and we then have what is known as dislocated spleen. The symptoms may disappear or the condition may give rise to very dangerous symptoms. Dragging on the stomach is very apt to cause dilatation with possible resultant rupture while interference with the bile duct, from dragging on the duodenum, causes intermittent attacks of jaundice. The formation of adhesions may cause intestinal obstruction or it may cause uterine retroflexion or prolapse, by passing into the pelvis.

Diagnosis.—Absence of the normal splenic dulness and the presence of a movable tumor with a notch which may be replaced to the normal position of the spleen is diagnostic. The usual course of travel of wandering spleen is parallel to its long axis diagonally toward the navel, and then the course varies so that the organ may be mistaken for any other abdominal organ. If it becomes fixed, diagnosis may be very difficult. Wandering spleen is most often confused with the left kidney, but may be differentiated by the absence of urinary symptoms, presence of the notch and the possibility of replacement. It lies in front of the gastro-intestinal tract against the anterior abdominal wall. It must sometimes also be differentiated from ovarian tumors, ectopic pregnancy, fibromyoma of the uterus, fœcal accumulations and pelvic abscesses.

Treatment.—Mechanical methods are sometimes used, but, as a rule, are unsatisfactory. Murphy suggests the use of the X-ray to reduce the size, followed by a belt and pad. When surgical treatment is resorted to we may choose between splenopexy and splenectomy. According to some authorities fixation should be chosen when the symptoms are mild, while in more severe cases when the organ is diseased it should be removed. The Mayos advocate splenectomy in all cases as splenopexy is often followed by considerable pain and other unfavorable symptoms. Of 43 cases of splenectomy collected from literature by Warren there were only three deaths. Thus it would seem that removal of the spleen is the best course to follow except when contra-indicated by leukemia, infantile splenic anemia, splenomegaly or amyloid disease.

The material for this paper has been collected from the following works:

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